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Intriguing surface-extruded plastic flow of SiOx amorphous nanowire as athermally induced by electron beam irradiation

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Nanoinstability and nanoprocessing of SiOx amorphous nanowire at room temperature as induced by *in situ* electron beam irradiation in transmission electron microscopy are systematically investigated. It is demonstrated that in contrast to the crystalline nanowires where only the beam-induced ablation of atoms was observed, the amorphous nanowire herein can give rise to an arresting beam-induced surface-extruded plastic flow of massive atoms and surface migration of atoms in addition to the beam-induced ablation of atoms via the plastic flow and ablation. A new S-type deformed wire and the thinnest amorphous nanowire are elaborately created locally at nanoscale precision with a highly controllable manner depending on beam current density, beam spot size and beam position. The existing knock-on mechanism and simulation seem inadequate to explain these processes. But it is indicated that a much higher nanocurved surface energy of nanowires and an enhanced beam-induced soft mode and instability of atomic vibration control the processes.

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